

# MARS SCIENCE LABORATORY 2009 PROJECT OVERVIEW

## Key Features

*Mobile Science Laboratory*

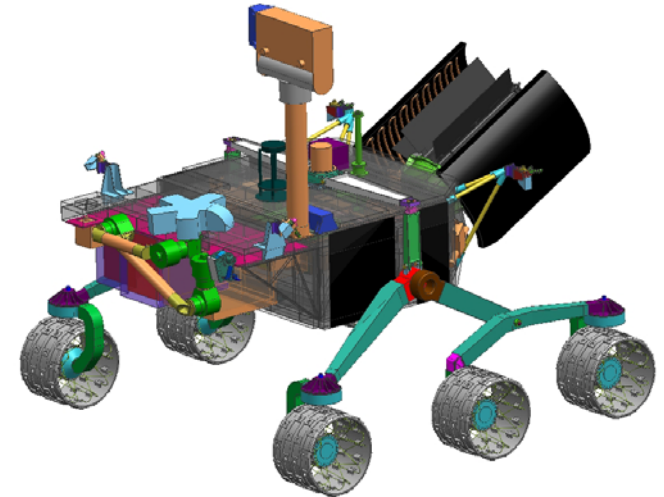
*Hundreds of days of surface operational lifetime*

*Discovery Responsive over wide range of latitudes and altitudes*

*Controlled Propulsive Landing*

*Precision Landing via Guided Entry*

*Planned Radioisotope Power Source for Electricity*



## Science

*Mission science will focus on Mars habitability*

*Next generation science investigations – Scientific Proposals Currently in Preparation, Selection later this year*

# Mission Architecture



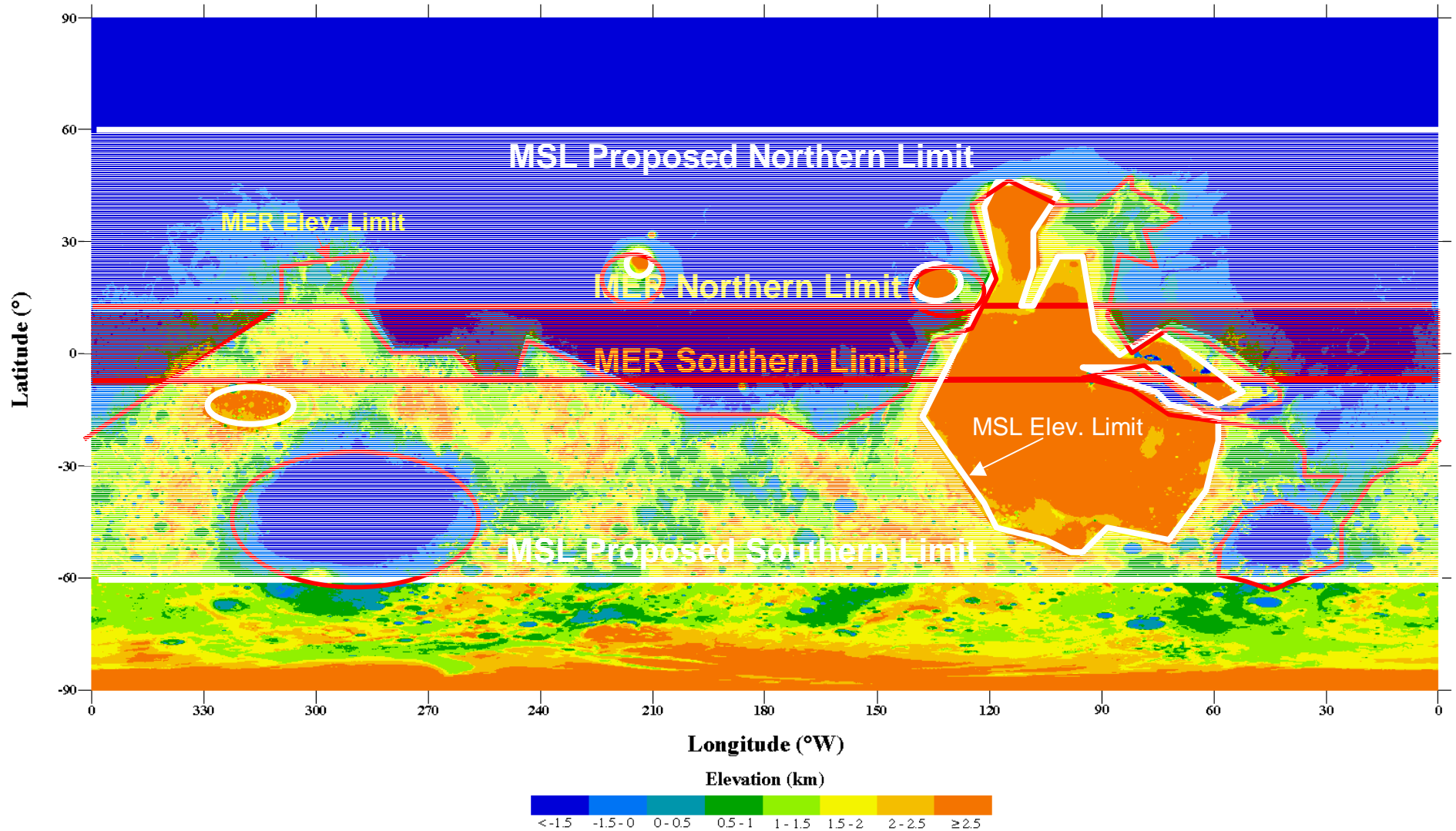
*PRE-DECISIONAL; For discussion purposes only*

# Science Vision for Mars Science Laboratory

- MSL will open a new era of Mars exploration by:
  - Providing scientific instruments of greatly improved accuracy (Analytic Laboratory)
  - Utilizing mobility and long life to examine multiple samples from multiple locations
  - Definitively characterizing a broad array of geologic materials
  - Beginning the investigation of the building blocks of life, including inorganic and organic carbon
  - Revealing crucial details about the climate and geologic history of Mars
- This will substantially advance our understanding of Mars and its **capacity to sustain life**

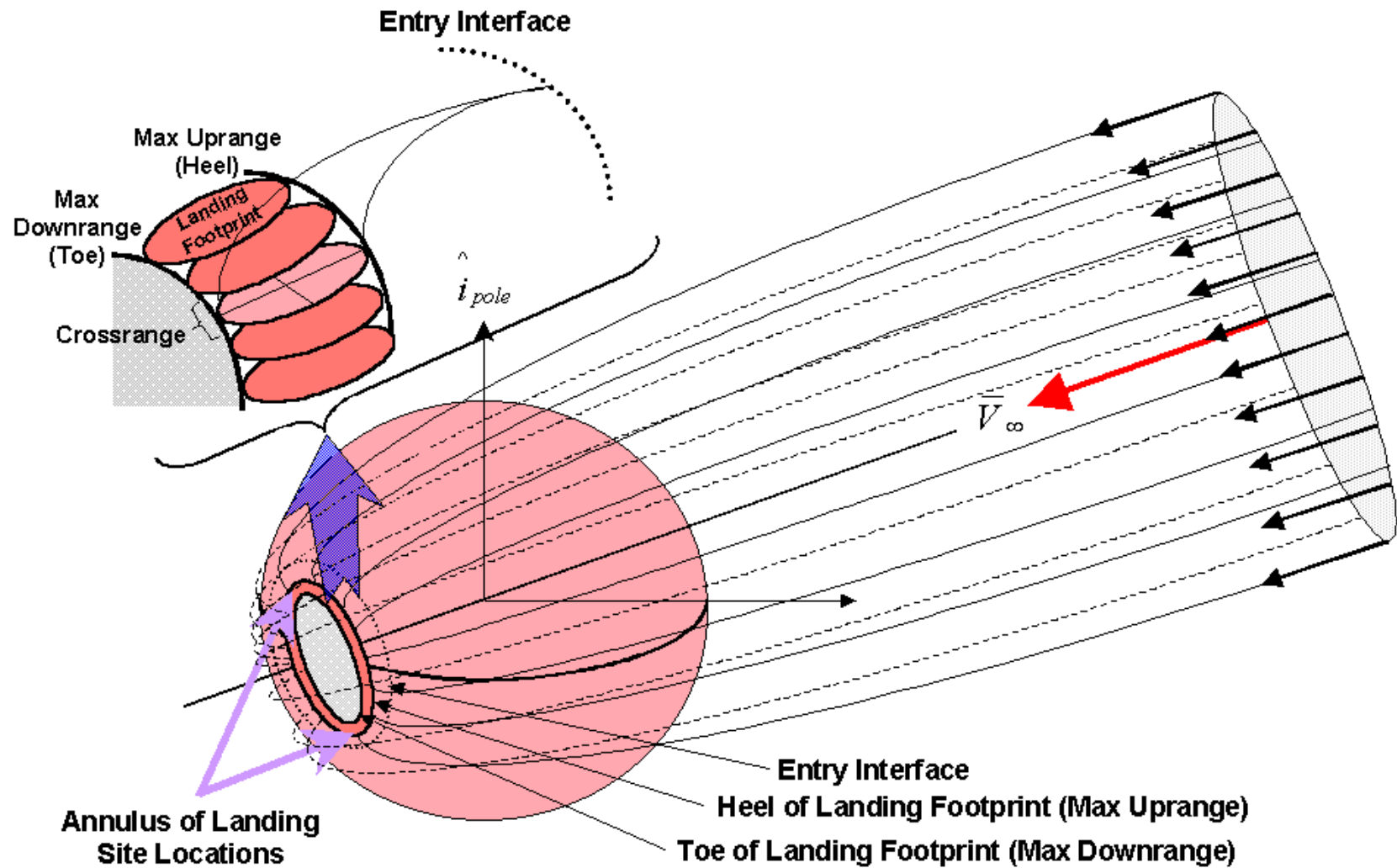
# Mars Surface Accessibility

## MOLA 1/4° Gridded Topography



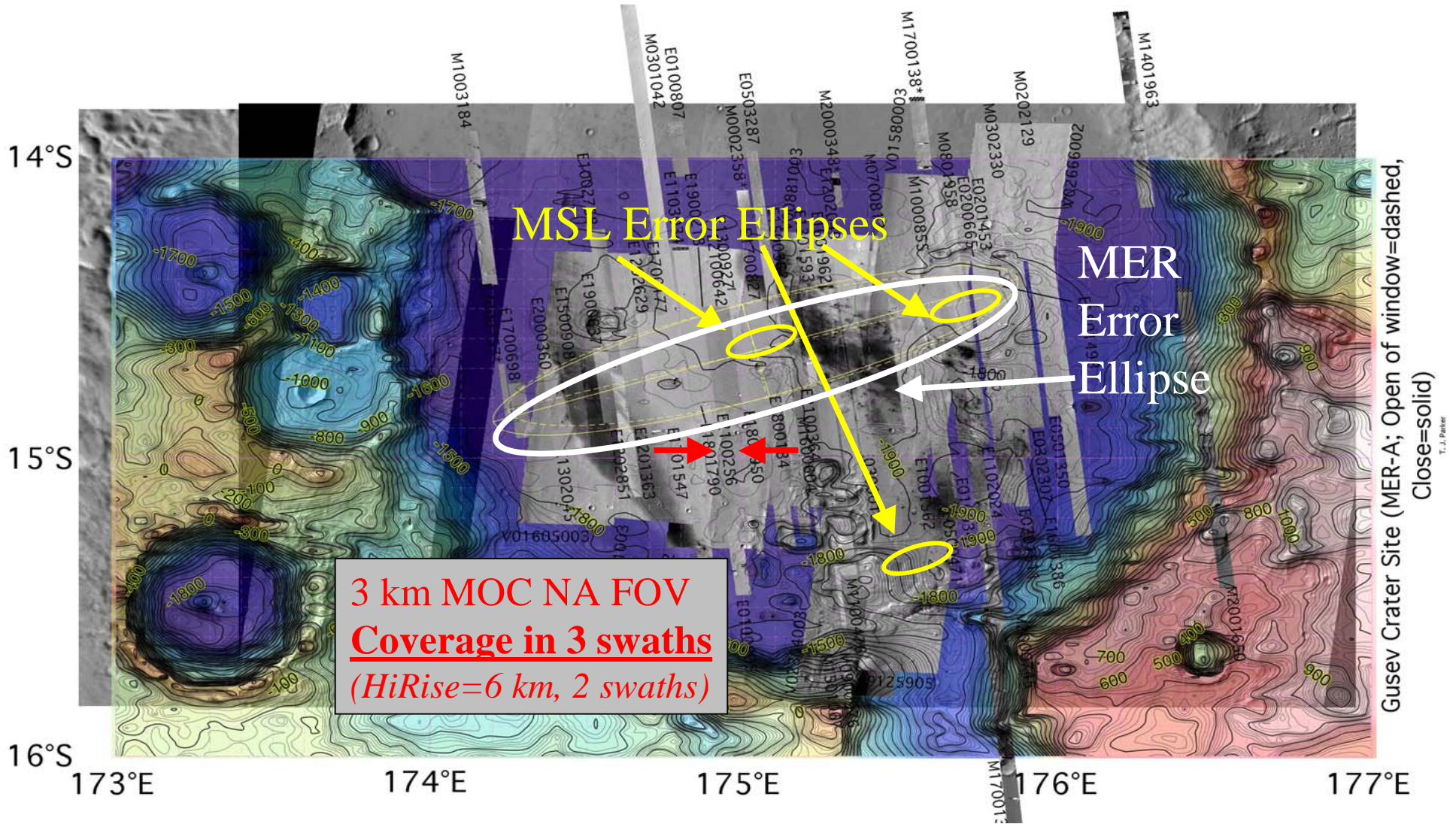
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# Mars Entry & Landing



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# Gusev Comparisons

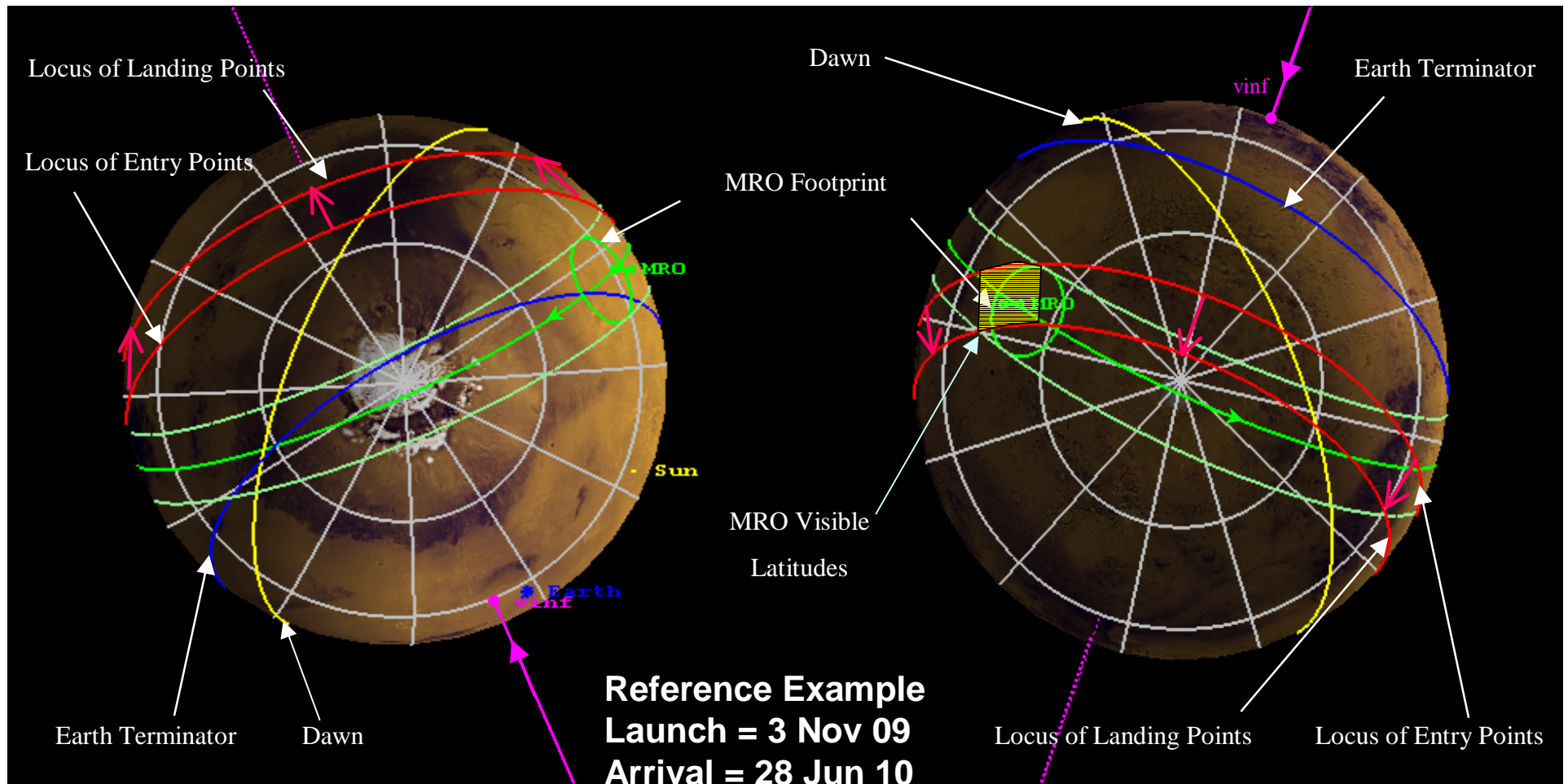


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# Arrival Geometry and Communications Studies

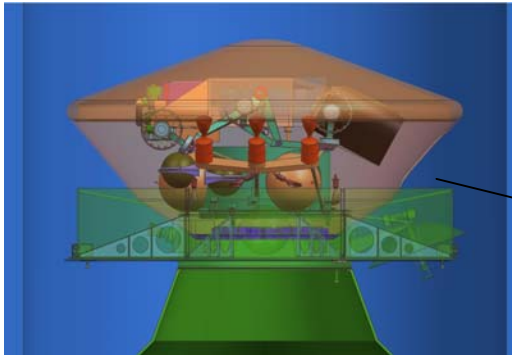
## NORTH POLE VIEW

## SOUTH POLE VIEW

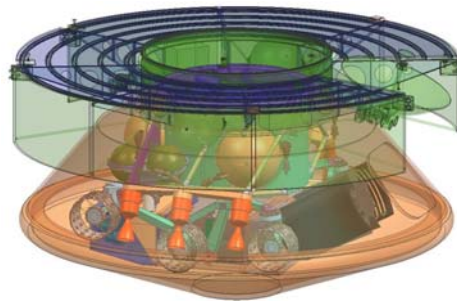


# Major Assemblies

Launch Configuration



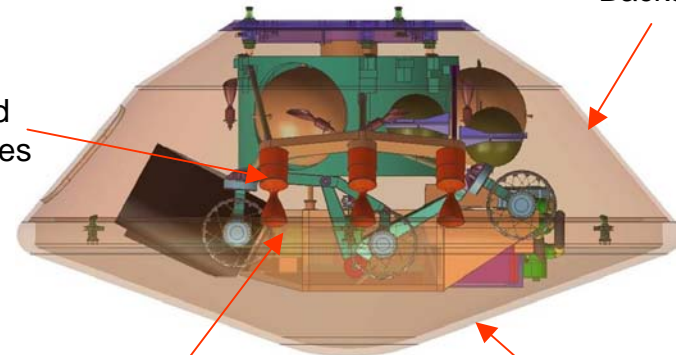
Cruise Configuration



Entry Configuration

6x modified  
Viking engines

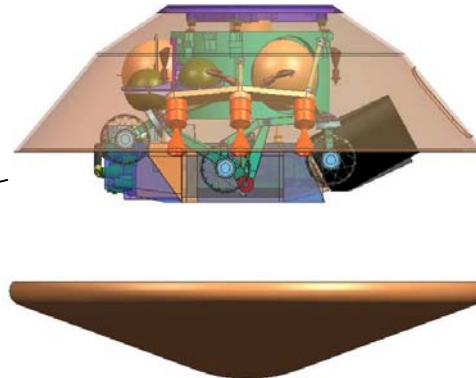
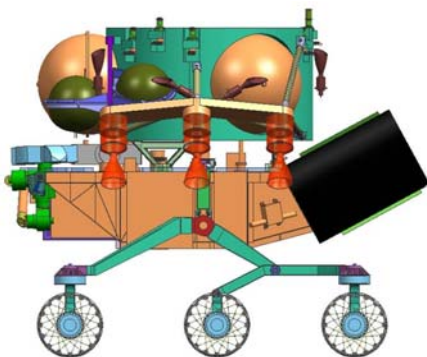
Backshell



Rover

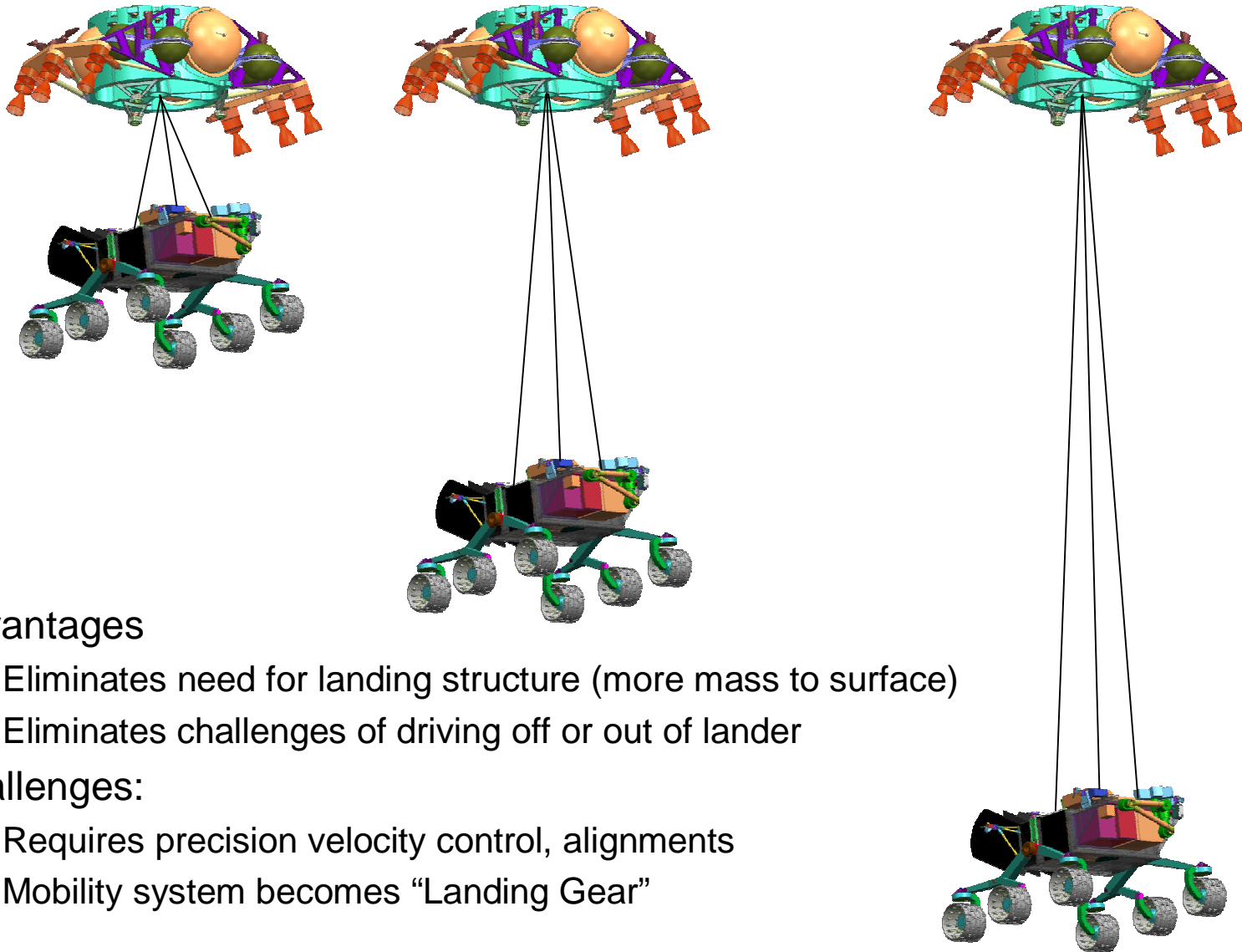
Scaled Viking  
Heatshield

Descent Configuration



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# Descent Stage Concept

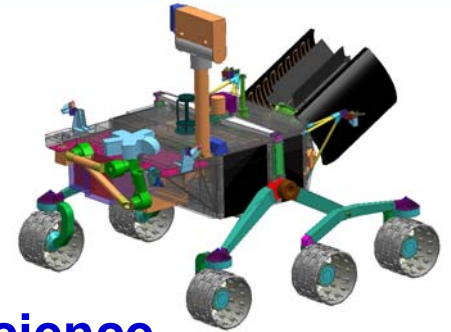


- Advantages
  - Eliminates need for landing structure (more mass to surface)
  - Eliminates challenges of driving off or out of lander
- Challenges:
  - Requires precision velocity control, alignments
  - Mobility system becomes “Landing Gear”

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# Science Strategy Elements

1. Site Selection (**safe, scientifically rich, discovery responsive**)
  - Small landing ellipse
  - Wide latitude and altitude range
  - Full use of information from Vikings, Pathfinder, MGS, Odyssey, MERs, MEX, Beagle, MRO and Phoenix
2. Analytic Laboratory Sample Selection (**synergistic science, dozens of samples**)
  - Remote sensing
  - Mobility
  - Contact suite with tools (**arm[s], Rock Crusher, Sample Distribution Device, Rock Abrasion Tool [RAT], Corer, and Scoop**)
  - Long life



# MSL Science Payload Suites

## **1. Remote Sensing Suite (“See”)**

- Imaging and complementary mineralogy
- Reconnaissance and site geologic context

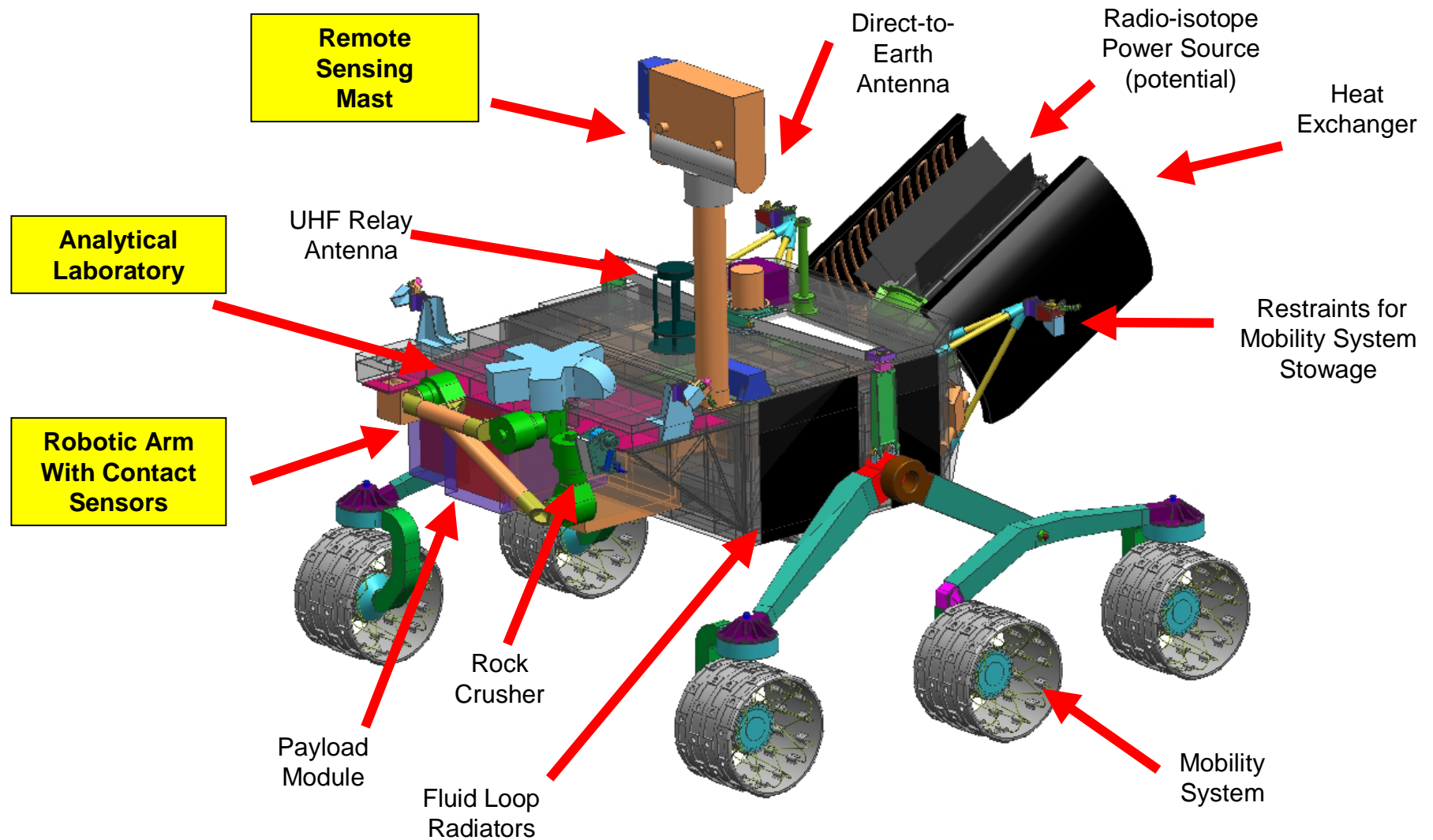
## **2. Contact Instrument Suite (“Smell”)**

- Complementary mineralogy, chemistry and microscopic imaging
- Sample selection and supplemental target analysis

## **3. Analytic Laboratory (“Taste”)**

- Definitive mineralogy, chemistry and high resolution textural information

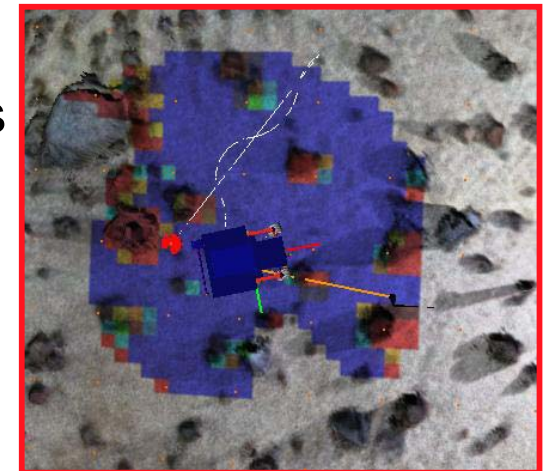
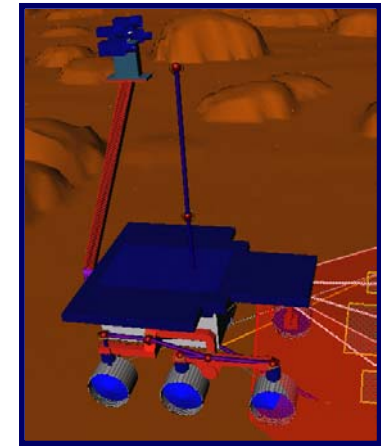
# Rover View



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# Pre-cursor Technology Investments

- Project is being preceded by substantial “focused” technology program
- Major thrusts aligned with project challenges:
  - Entry, Descent and Landing Technologies
  - Long-lived Surface System Technologies
  - Advanced Robotics Technologies
  - Sample Acquisition and Handling Technologies
  - Advanced Software and Autonomy Technologies
- Technology Maturation Assessment to be completed prior to the project’s Preliminary Design Review in 2006.



# MSL provides a Transition to the of Next Generation Mars Exploration

- The flight system would have many **capabilities** (e.g. latitude & altitude range, life, mobility, modularity, guided entry, low landing velocity, etc.) which are ideal for future extensive surface exploration with lowered development risk
- MSL represents a **transition mission** in that while it incorporates elements of geology and climatology, it strongly emphasizes definitive geochemistry and a search for carbon in all its forms
- This combination would provide a **powerful predicate** to future exploration which will likely include a search for extant life, the return of samples and deep drilling